Remarks by the Honorable Sean O'Keefe
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Thank you Drayton (Drayton McLane Jr.) for that wonderful introduction. And thank you President Bawcom, (Dr. Jerry Bawcom) for the honor of being here today to address the students of your great university and distinguished members of the Belton community.

On behalf of the dedicated men and women of NASA I am delighted to present the McLane Leadership Lecture about NASA's continuing efforts in this Centennial of Flight year to pioneer the air and space frontier.

In my remarks today, I want to speak about the century of exploration and discovery that lies ahead, and my hope that many of you will help to participate in the adventures to come, whether you are working for NASA, discovering new ways to heal the sick or teach the young, or charting new pathways in business enterprise like Drayton McLane.

But before we know where we are going, as your History teachers are certain to tell you, it is useful to appreciate how far we've come.

Just before the turn of the last century, the head of the U.S. Patent Office considered closing that office, since it was obvious that there was nothing left to event. In 1895, Lord Kelvin, then President of the prestigious Royal Society of England, said with absolute certainty, "Heavier than air flying machines are impossible." Eight years later, two bicycle makers from Ohio, Orville and Wilbur Wright, who were dumb enough not to listen to this eminent authority from the Royal Society, proved him wrong. And in the century that followed, astounding technological developments have enabled people to fly around the world with ease and brave explorers to extend our reach into the heavens.

This very day, two of those space explorers, astronaut Michael Foale and cosmonaut Alexander Kaleri are currently orbiting 250-miles above our heads onboard the remarkable football-field sized research facility known as the International Space Station. On Sunday, they marked the Space Station's third year of continuous human occupancy. Accordingly, we should recognize that the students here today are part of the first generation to be alive in which there will always be people living and working in space, a remarkable accomplishment in human history.

We should recognize however, that every step of the way in the age of flight, we have achieved our breakthroughs and

triumphs, only after having suffered through enormous setbacks, learning from them, and rebounding to continue our unceasing efforts to explore the unknown.

Next month when the Centennial of Flight is celebrated at Kitty Hawk, North Carolina, you probably won't hear anything about Lt. Thomas Selfridge. But you should know who he is. Five years after their first flight, the Wright brothers were demonstrating their flying machine to the U.S. Army just across the river from our Nation's capital, with Lt. Selfridge riding as an observer in the plane, which was piloted by Orville. The Wright flyer crashed, and Selfridge died of head injuries, thus becoming the first fatality of powered flight. Rather than treating this accident as a reason to halt everything, aviation advocates worked their way through the problem, and developed the crash helmet, allowing the rapid advancement of aviation progress.

I have thought often of this example following the tragic accident over the skies of east Texas that took the lives of our heroic Columbia astronauts nine months ago. It is indeed our solemn commitment to the families of these brave space explorers and to the American people that we will learn from this horrible accident and return to Shuttle flight operations conducted as safe as humanly possible.

Last week the names of the Columbia astronauts were given permanent places of honor on the Space Mirror Memorial, at the Kennedy Space Center in Florida, reminding us once again of the remarkable achievements of these seven extraordinary individuals.

I'd like to give the students in attendance some perspective about the tremendous legacy of these seven space explorers, so that you might learn from their dedication to the pursuit of exploration and discovery.

Our Columbia astronauts were as fine a crew of space explorers as has ever been assembled. The astronauts, who represented such a wonderful tapestry of different races, religions and nationalities, demonstrated through their genuine love for each other the essential brotherhood and sisterhood of humanity. Not a day goes by in which we don't miss their joyful presence. Not a single day.

In their mission dedicated to life and physical science research the astronauts worked tirelessly on a range of experiments having objectives as diverse as fighting cancer, improving crop yields, developing fire-suppression techniques, building earthquake resistant buildings, demonstrating new combustion techniques that could revolutionize flame burning engines and understanding the effects of dust storms on the weather.

As their family members so eloquently stated, the crew headed into space with "hearts full of enthusiasm, pride in country, faith in their God, and a willingness to accept risk in the pursuit of knowledge—knowledge that might improve the quality of life for all mankind."

Fortunately, a significant amount of data from their 16-day mission devoted to life and physical science research was recorded, and scientists are now pouring over the results. They expect what we learn from the Columbia experiments will tangibly help millions of people here on Earth. We can thank our Columbia crewmembers for this most valuable harvest in this season of harvests.

We will never forget their contributions, and we will honor their legacy by learning from the tragic accident and moving forward to resume Shuttle flight operations that advance the noble goals that motivated our astronauts. This is indeed what each of the family members of these seven courageous people have implored us to do.

To be certain, the Columbia accident was a huge blow to all of us engaged in extending the human horizon into the space frontier. I think what sustained many of us in those sad days following the tragedy was the inspiring, incredible strength of the Columbia families. We were also bolstered by the tremendous

outpouring of sympathy and appreciation for the contributions of the astronauts that were expressed by people throughout our land, and indeed throughout the world.

I would like to thank Drayton McLane in particular for his incredibly thoughtful gesture to memorialize the Columbia astronauts by placing their crew patch on the uniform of the Houston Astros this season and by inviting the astronauts' children to throw out ceremonial first pitches on Opening Day of the baseball season. I can think of many memorable pitches in baseball this year, but to me, those were the best. Thank you Drayton, for your heartfelt salute to the astronauts and their families and for providing all of us this precious memory.

There are some other people in Texas who have earned NASA's deepest appreciation. These are the folks from the east Texas communities of Lufkin, Hemphill, Nagadoches, Palestine and Corsicana. On February 1st and the days that followed, the citizens of these communities invited our NASA people and colleagues from our partner organizations into their homes and hearts without hesitation, while we mounted an unprecedented three month activity to assure public safety recover vital evidentiary debris from the Columbia accident to inform the investigation of how this tragedy happened.

The good citizens of these places could not have possibly planned for the 25,000 responders representing 130 governmental and volunteer agencies, private groups and contractors who descended on their communities to conduct the recovery effort. But they gladly housed us, fed us and invited us to join them in their houses of worship. We will never forget their warm hospitality.

The recovery operation in the piney woods of east Texas and west Louisiana is an important and underreported story. Just as we learned from the Wright flyer accident in 1908, the recovery operation provided us vital clues that have helped us understand what caused the Columbia accident, clues that will help us improve the safety of the Shuttle orbiter in the future.

When we set out to collect as much of the Columbia as we could to assure public safety and to aid the accident investigation, experts told us that at best we could recover about fifteen percent of the vehicle. Amazingly, when the recovery effort was completed in early May—involving a careful air, ground and underwater search of an area about the size of Rhode Island—nearly 40 percent of the orbiter was recovered, including several key parts from the left wing of the Columbia and the critical onboard data recorder that eventually verified and validated

so much of what we learned from Mission Control on the day of Columbia's attempted landing.

What we learned from the recovery effort helped the independent Columbia Accident Investigation Board develop a comprehensive report on the causes of the Columbia accident. Our Nation owes the Board and its chairman Admiral Hal Gehman a debt of gratitude for helping to clearly pinpoint the combination of technical, human and process errors within NASA that led to the tragedy.

We have embraced the report of the Columbia Accident Investigation Board. It has put us on a path to safely return to fly. We intend to implement the Board's recommendations to the best of our ability, and will also seek ways to go further in setting the safety bar even higher as we emerge from the Columbia accident as a safer, smarter and stronger Agency. Throughout our NASA family, our dedicated scientists and engineers are working to organize everything we do—not just our human spaceflight activities—around an uncompromising ethos of safety first.

I know the American public is counting on us to learn from our mistakes and to move forward as President Bush has said with "focus, professionalism, and unbroken faith in the mission of this Agency." And that's exactly what we are doing.

We are embarked upon this painstaking Return to Flight work because spaceflight is a means to an end and at NASA that end is exploration, discovery and inspiration. NASA's seeks on behalf of the American people to "understand and protect our home planet, explore the vast Universe and search for life, and inspire the next generation of explorers."

I'd now like to share with you a description of our current activities and direct your focus to a time in the not too distant future when some of the students in this audience may help extend our horizons throughout the solar system.

At this very moment, NASA's work to accomplish our ambitious mission goals continues as astronauts Michael Foale and cosmonaut Alexander Kaleri conduct important research and operational activities onboard the football-field sized research laboratory known as the International Space Station. Michael and Alexander are members of the eighth Expedition crew to work on the Space Station.

I think it is unfortunate these days that the public doesn't know our current astronauts with the same familiarity as my generation got to know such space explorers as John Glenn and Neil Armstrong. So let me tell you a bit about Michael, who is the Mission Commander and NASA Space Station Science Officer and Alexander, who is the Flight Engineer.

Michael, a veteran of five space flights, is the first American astronaut to hail from our mother country. One year before NASA was established he was born in Louth, England. His father, Colin, was a Royal Air Force pilot. His mother, Mary, is from Minnesota. One of Michael's fondest memories is seeing John Glenn's Friendship Seven Mercury capsule at an exposition in Minneapolis.

Michael received his doctorate in astrophysics from the University of Cambridge, Queens College. While pursuing his postgraduate studies at Cambridge University, he became an aquanaut of sorts, helping to organize several scientific scuba diving projects. But his heart was set on becoming an astronaut, and he followed his heart to Houston, where he began working for NASA on Space Shuttle payload operations in 1983. Four years later he was selected as an astronaut candidate. Michael soon joined other astronauts in preparing for our participation in long-duration flight on the Russian Space Station Mir.

On his most memorable space flight, Michael spent 145 days onboard MIR. Midway through his flight, a Progress resupply ship collided with the Mir and there were a few harrowing moments when the MIR started to depressurize. Michael responded magnificently to this challenge, working with cosmonaut Anatoli Soloviev (Solo-Vee-Ev) to quickly repressurize the MIR. He then

took a six-hour space walk to inspect damage caused by the collision. Michael is also credited with some more space history for his work with our STS-103 crew four years ago to repair and upgrade the Hubble Space Telescope, which today continues to help scientists unlock the most profound mysteries of creation.

Alexander Kaleri has logged a total of 416 days in space and four space walks on three MIR missions. Indeed, he was on the last crew to occupy the MIR three years ago. Born in 1956 in Yurmala, Latvia, Alexander remembers thinking about becoming a cosmonaut, when boys in his country pretended they were Yuri Gagarin, just as our youth dreamed of growing up to be like John Glenn and our other Mercury astronauts.

As a space flight veteran Alexander has worked with crewmates from a number of nations and he recognizes the value of international cooperation in space. He recently told an interviewer, "The International Space Station is a very good step forward, and it's a very good experience for us that can show us how to work together in the future. If we put this task in front of ourselves and learn how to operate very difficult scientific projects, we'll be able to reach much more in the future. We can go together on Mars, we can go to other planets."

Let me tell you something about the capabilities of the International Space Station, and why it is so important to our

future. This platform is capable of advancing research spanning across such scientific disciplines as human physiology, genetics, plant biology, earth observations, physics and cell biology.

From these experiments, scientists are learning better methods of drug testing, developing models that predict or explain the progress of disease; investigating how to use microbes to make antibiotics, and determining how to improve manufacturing processes. In short, this research is helping to better all of our lives.

One aspect of Space Station research, I believe, is particularly intriguing and potentially of tremendous benefit to us. We know that in the six months our Expedition crews spend onboard the facility, crew members typically lose about 30 percent of their muscle mass and about 10 percent of their bone mass in this zero-gravity environment. Fortunately, they recover this mass upon their return home. But with the future needs of long-duration space flight in mind, we are working hard to learn how we might arrest this pattern.

Now think about what a solution to this condition might mean to the millions of people—our parents and grandparents who lose bone mass as a result of the natural aging process, and suffer through the pains associated with osteoporosis. That is one of the reasons why we conduct these experiments in space.

As the second century of flight unfolds, we will also extend our horizons further outward as we make progress toward our second set of mission goals of exploring the Universe and searching for life.

In January, the twin Mars Exploration Rovers, Spirit and Opportunity, will parachute to an airbag-cushioned landing on the red-planet and begin a several week search for evidence of free flowing water in the planet's ancient past. This will be a seminal moment in our unceasing quest to search for life in the Universe, as we know that water is one of the critical incubators of life as we know it. The twin rovers, each the size of a golf cart and weighing 375 pounds will ramble dozens of meters a day, drilling into rocks and scooping up soil in preliminary field studies to help identify ancient oases at the designated landing sites. Back here on Earth, I trust many of you will intensely follow this latest milestone in planetary exploration via television and the Internet.

Incidentally, the twin Mars Exploration Rovers received their names as the result of a NASA-sponsored essay contest won by Sofi Collis, a delightful third grader from Scottsdale, Arizona. She's got a fascinating story.

Sofi was born in Siberia and adopted by folks in Scottsdale when she was about three years old. She has in her heritage and upbringing the soul of two great space faring countries to be sure.

In her essay, Sofi wrote, "I used to live in the orphanage. It was dark and cold and lonely. At night I looked up at the sparkly sky. I felt better. I dreamed I could fly there. In America I can make all my dreams come true. Thank you for the spirit and the opportunity." And so we named the rovers, Spirit and Opportunity in honor of a girl who like many of us understands what the American dream is all about.

Now looking further out into the solar system, another of our future space exploration objectives is to develop new propulsion systems that will significantly enhance the ability of our robotic spacecraft to perform scientific investigations of planets.

We are looking at propulsion systems that will allow robotic missions for the first time to be redirected to take advantage of circumstances as they unfold, just as Lewis and Clark redirected their voyage nearly 200 years ago when it became clear there was no single water passage to the Pacific Ocean.

Our first demonstration of this technology will a mission that will allow us to send a spacecraft on a complex, multiple orbit examination of Jupiter's fascinating icy moons, including the Moon Europa, which may have a vast ocean conducive to life beneath its icy surface.

We further believe that the pursuit of nuclear and other advanced propulsion technologies will open the door to other

power generation and propulsion technologies that may make it feasible to an even quicker pathway to that future.

When our future spacecraft go to the planets, they may also be using another transformative technology we're working on in the realm of laser communications.

Following in the same progression that led from the Telegraph to the Telephone, our Optical Communications efforts will use laser light instead of radio waves to revolutionize the way we gather and report back information to scientists here on Earth.

Now again, this is not just a dream. This technology will soon be demonstrated on a Mars orbiting mission, in six years. When successful we will be able to map the entire surface of Mars in four months. Today, using conventional radio frequency communications, the Mars Reconnaissance Orbiter will take roughly two years to map 20 percent of the red planet's surface. So this technology has a tremendous potential return.

It is technological capabilities like this that will open up fantastic avenues of scientific inquiry. And that's what NASA's work is all about. To make breakthrough technologies as opposed to incremental or marginal improvements each way.

Eventually we hope to expand our human presence beyond low earth orbit. But to do so we have a lot of work to do. We need to overcome a number of constraints related to how the human

body functions in space over lengthy periods, the current limitations of information systems and infrastructure, and our relative lack of experience beyond our planetary cradle. That is the task we have in the decades ahead. But as President Bush stated earlier this year, "The cause of exploration and discovery is not an option we choose, it is a desire written in the human heart."

Now because NASA has such important work ahead of us, we take very seriously our final mission goal of inspiring the next generation of explorers, those students in K through college who will enable this great cause of exploration and discovery to progress beyond our wildest imagination.

Our new Education Enterprise is building upon NASA's tradition of partnership with schools, museums, libraries, planetariums, and science centers in communities throughout the country to inspire and motivate students to pursue careers in science, technology, engineering, and mathematics. Hopefully, many of the people we reach will join the NASA team.

One of the means we are using to reach out to and motivate our future explorers is to recruit a very special cadre of astronauts, our Educator Astronauts. From a candidate list of 1100 we will select three to six K-12 teachers to join already designated Educator Astronaut Barbara Morgan in our first Educator Astronaut Class.

The people we select will be trained to perform regular astronaut duties and will also use their unique platform on future Space Shuttle and Space Station missions to convey to students on the ground the excitement of space exploration and to teach lessons about the wonders of science.

Barbara Morgan, who's a second and third grade teacher from Idaho, was originally selected to be the backup for teacher Christa McAuliffe on the Challenger mission in 1986. Following the tragic loss of the Challenger crew you'd think she might have given up on this. Instead, she redoubled her efforts. This is one of the most patient, persistent, and focused individuals that I've ever met. She began her full-time astronaut training about four years ago, and again, will be assigned to a mission to the International Space Station not long after we return to flight.

This audience should know that we are also focusing our attention on college-aged students, hoping to engage as many bright young people as we can in our work. We offer numerous summer job and scholarship opportunities as well as opportunities for promising young science students and their faculty members to participate in NASA research. We also have opportunities from time to time in non-scientific fields such as administration and public affairs. So I encourage any students in the audience to contact people at our various centers or to go to our web site at

www.nasa.gov to learn more about what it is like to be at a place where people come to work every day knowing that they may be able to do what no one has ever done before, and see things that no one has ever seen before.

In conclusion, I'd like everyone here today to open up your imaginations and consider what our world might look like in a few decades, as NASA, aided by that next generation of explorers, continues to extend our reach ever-outward into the heavens.

When the history of the first quarter of the 21st century is written, we can imagine that NASA will have sought life's abodes in our corner of the universe. Our astronomers, exobiologists, and planetary geologists will help map continents on dozens of planets circling nearby stars, some of which will show signs of life-supporting atmospheres.

We will also carry forward the search for evidence that life exists on planets within our own solar systems, as revealed by advanced generations of robotic explorers such as Spirit and Opportunity.

NASA's scientists and engineers will also assist with space missions to help reveal the complex interactions among Earth's major systems. We are at the cusp of being able to vastly improve the prediction of weather, long-term climate, earthquakes and

volcanic eruptions and for obtaining a greater understanding of the Sun's influence on our living world.

Speaking of breakthroughs, people often forget that NASA owes its roots to our nation's heritage of pioneering the aviation frontier. In this, the year that marks the Centennial of Flight, we are pushing ahead with the development of technologies that will result in quieter and less air-polluting aircraft, higher-speed international air travel, and innovative methods to reduce aircraft accidents. Maybe one of these days, people will fly above ground in personal vehicles like those in the movie Minority Report. Maybe one of you will help bring this technology about.

I'm also confident that NASA will also help bring about the new commerce that our expanded technological reach into space will enable. The day is near that low-Earth orbit will become a rapid growth economic zone, with commercial industries taking advantage of low gravity, abundant solar energy, and a vista for research that encompasses the entire planet.

This is the world that all of you will grow up in. This is the world that you will help to create.

And throughout this world, students in Earth-bound classrooms will learn, just as you have learned, about the fundamentals of physics, mathematics, and technology. Their learning experience will be somewhat different than yours as the

students of tomorrow will be able to actively interact with space explorers trekking throughout the solar system via telepresence technology.

In closing, as we contemplate our return to flight and the tremendous feats of exploration that you will witness and contribute to in your lifetime, I'd like to leave you with a quote from the distinguished American jurist Oliver Wendell Holmes. "Greatness is not in where we stand, but in what direction we are moving. We must sail sometimes with the wind, and sometimes against it – but sail we must, and not drift, nor lie at anchor."

Again, thank you for being such a wonderful audience and for inviting me to speak to you today.